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(54) **SHEET STORAGE APPARATUS AND IMAGE FORMING APPARATUS**

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(56) **References Cited**

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U.S. PATENT DOCUMENTS

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

5,632,477 A * 5/1997 Morinaga B65H 1/08 271/127
6,409,165 B1 * 6/2002 Yamaoka B65H 1/12 271/127

(Continued)

(21) Appl. No.: **14/989,978**

FOREIGN PATENT DOCUMENTS

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JP 11-59925 A 3/1993
JP 08-034527 A 2/1996
JP 2002-362757 A 12/2002

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(30) **Foreign Application Priority Data**

(57) **ABSTRACT**

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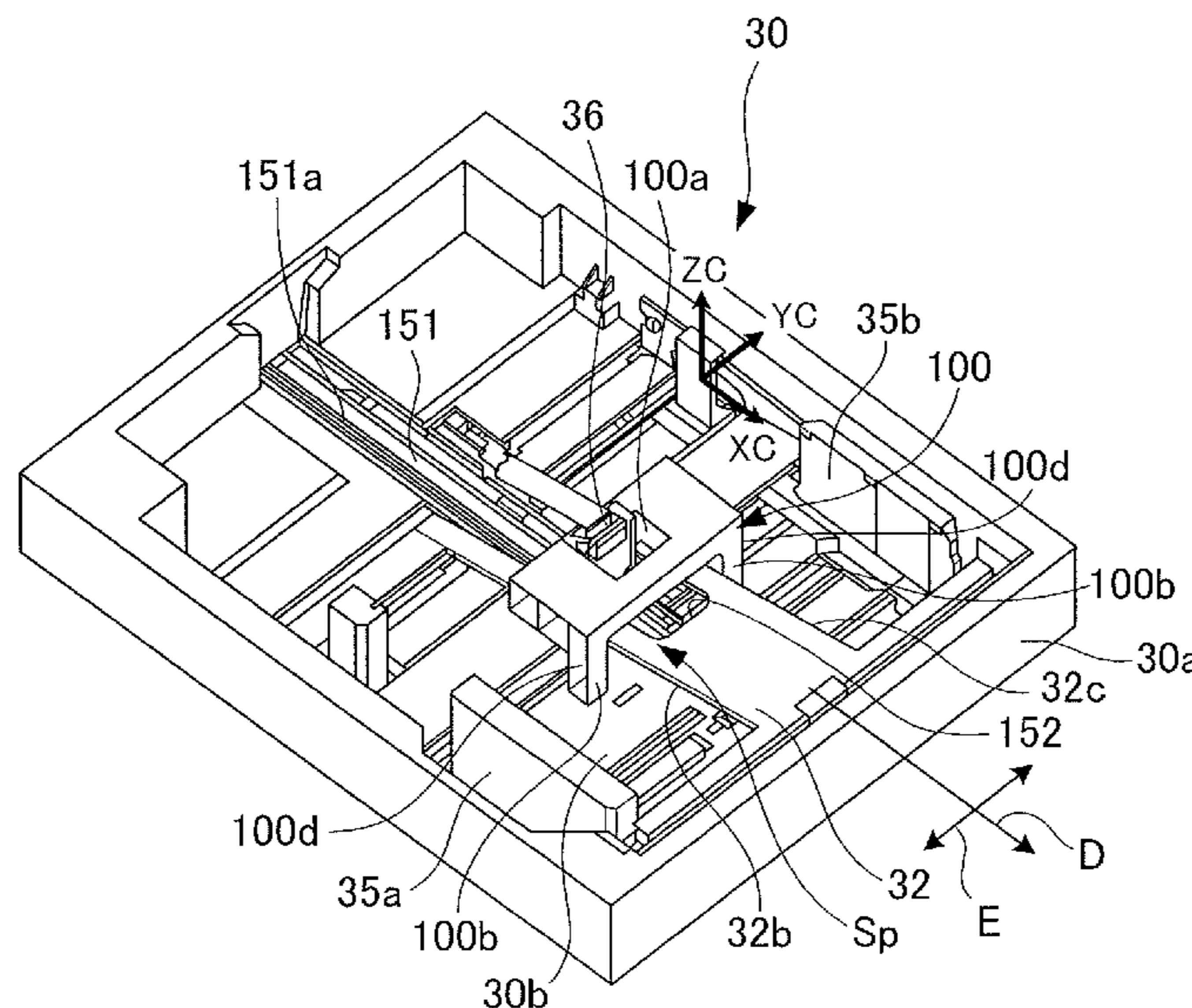
A sheet storage apparatus includes a storage apparatus body, a sheet stacking portion, a rear end regulation member, and a rear end regulation attachment. The sheet stacking portion has an opening opened in an upward and downward direction, and is movable upward and downward with respect to a bottom portion of the storage apparatus body. The rear end regulation attachment is detachably attached to the rear end regulation member, which regulates an upstream end position in the sheet feed direction of the sheet stacked on the sheet stacking portion. The rear end regulation attachment includes a regulating portion that extends toward the bottom portion through the opening. The rear end regulation attachment regulates the upstream end of the sheet on a position downstream, in the sheet feed direction, of a regulating position of the rear end regulation member.

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B65H 1/04 (2006.01)
B65H 1/26 (2006.01)

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16 Claims, 10 Drawing Sheets



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2405/121 (2013.01); B65H 2511/11 (2013.01);
B65H 2511/12 (2013.01); B65H 2511/20
(2013.01); B65H 2511/22 (2013.01); B65H
2701/1916 (2013.01)

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USPC 271/171, 223
See application file for complete search history.

(56)

References Cited

U.S. PATENT DOCUMENTS

6,826,374	B2	11/2004	Kato et al.	
6,904,261	B2	6/2005	Fujii et al.	
6,997,449	B2	2/2006	Obuchi et al.	
8,550,461	B2	10/2013	Sekigawa et al.	
8,960,668	B2	2/2015	Obuchi	
9,260,262	B2 *	2/2016	Matsumoto	B65H 1/266
2004/0135306	A1 *	7/2004	Takahashi	B65H 1/04 271/145
2009/0295073	A1 *	12/2009	Furusawa	B65H 1/266 271/171
2010/0221051	A1 *	9/2010	Yamazaki	B65H 1/04 399/400
2015/0097330	A1 *	4/2015	Sato et al.	B65H 1/14 271/160
2015/0115521	A1	4/2015	Ishida et al.	
2015/0203311	A1 *	7/2015	Matsumoto	B65H 1/266 271/241

* cited by examiner

FIG. 1

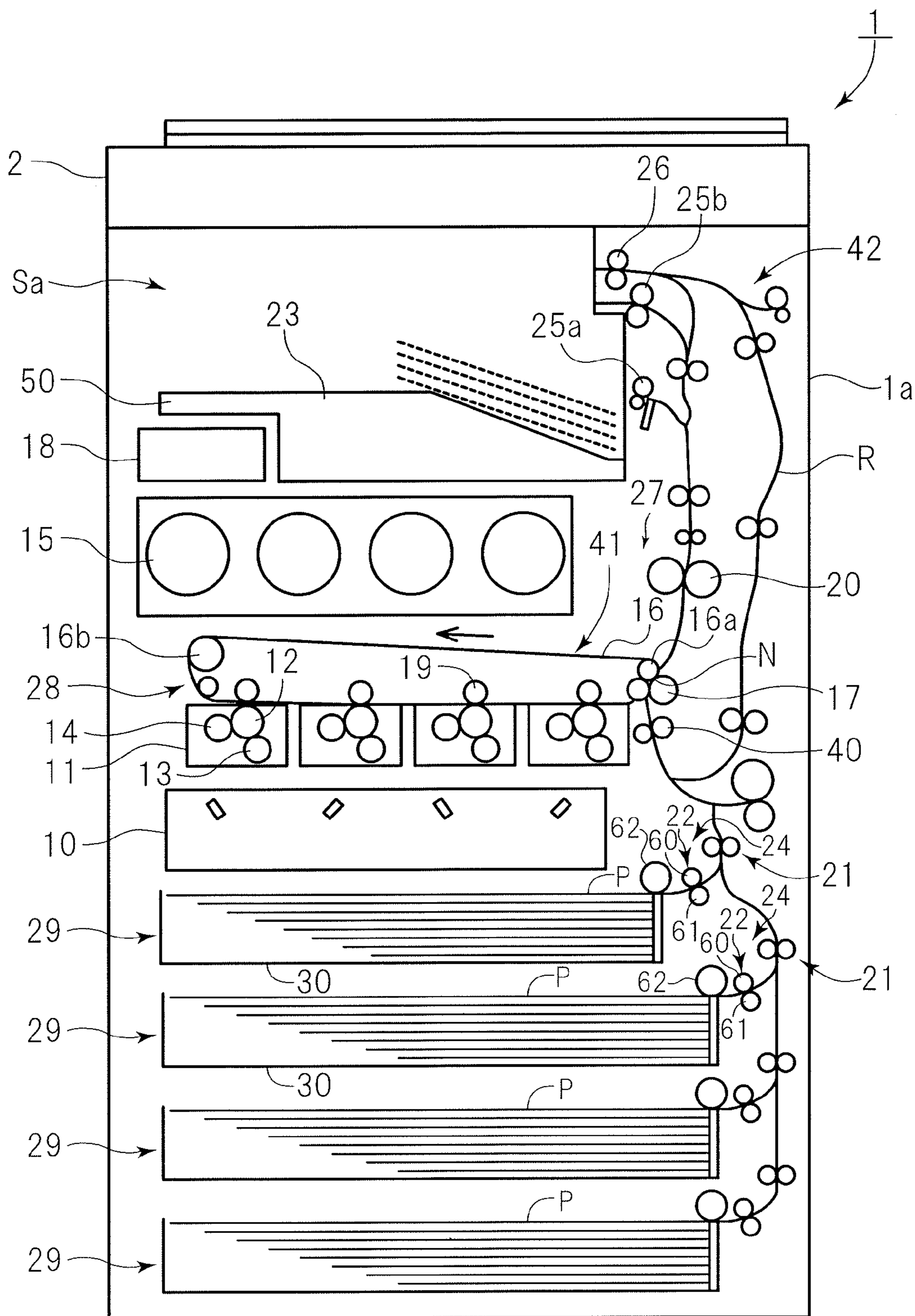


FIG.2A

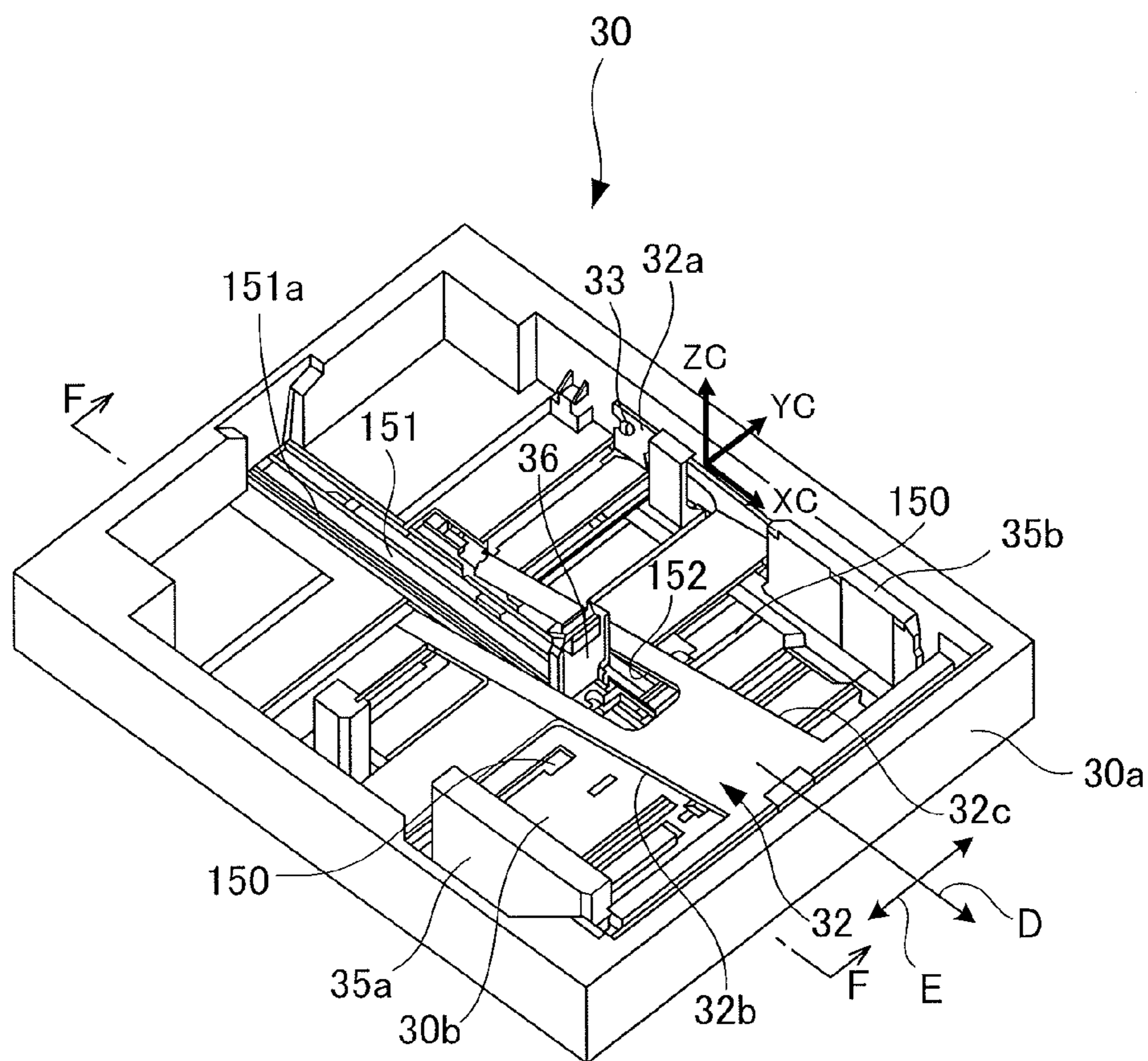


FIG.2B

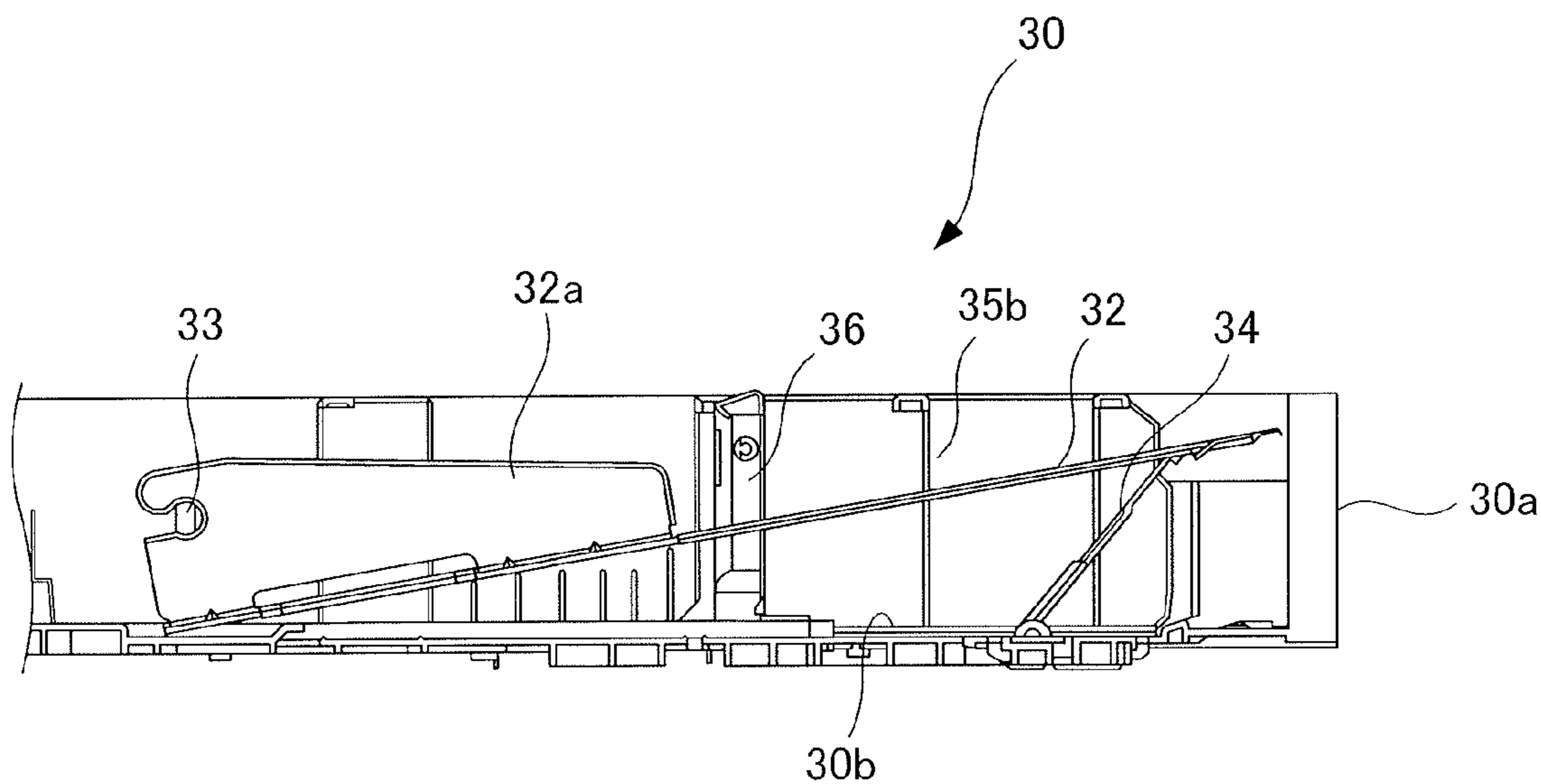


FIG.3

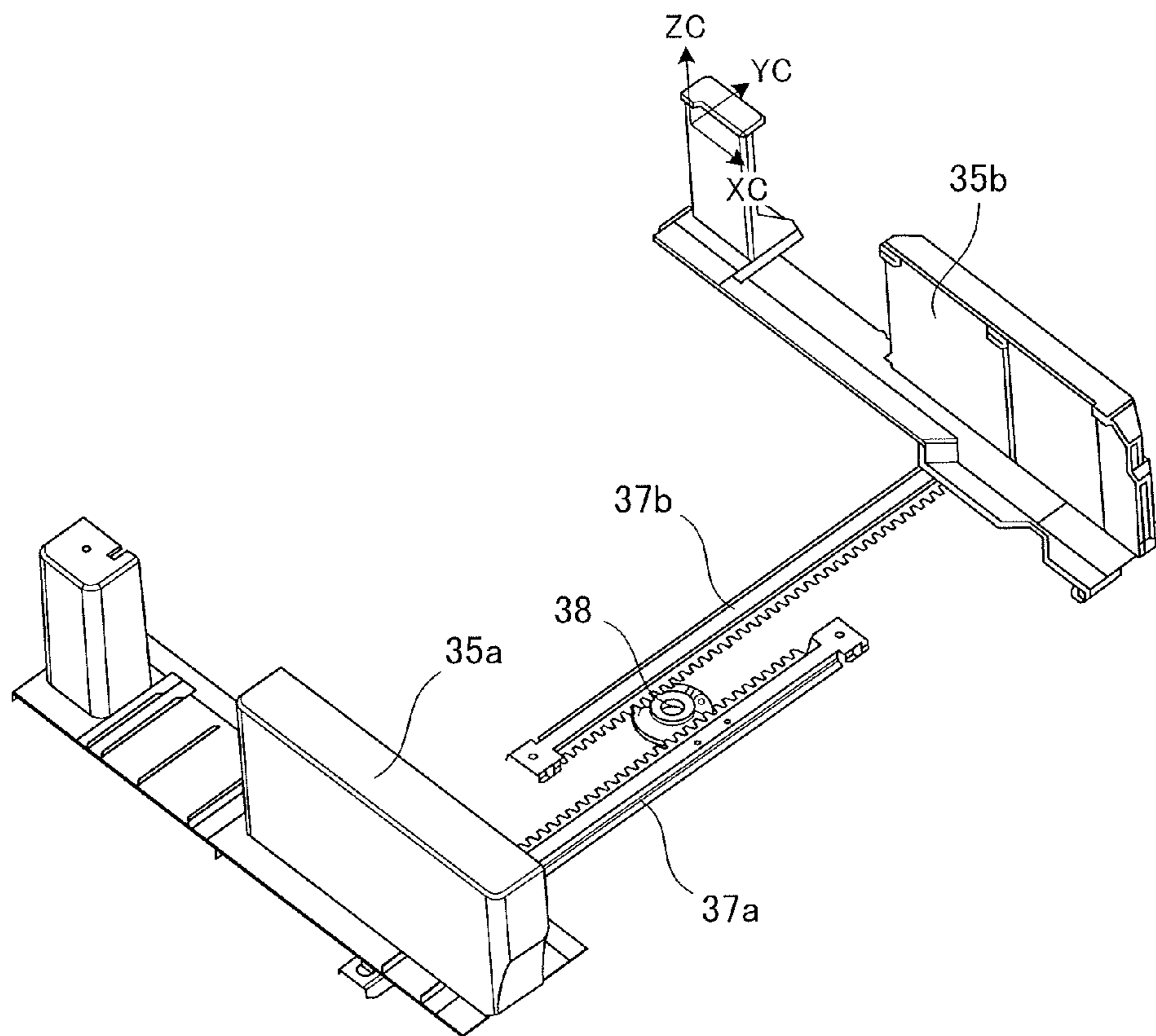


FIG.5A

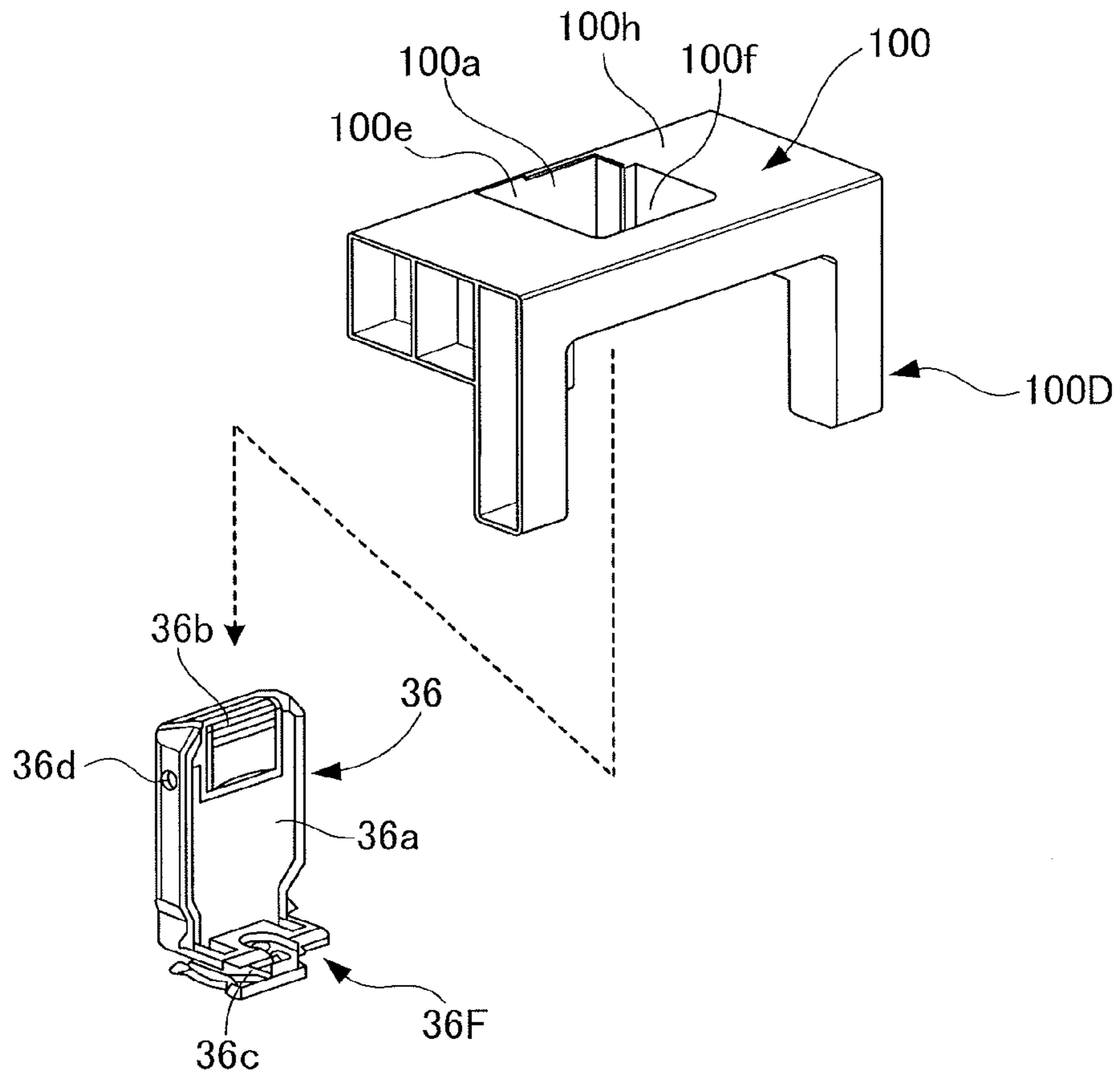


FIG.5B

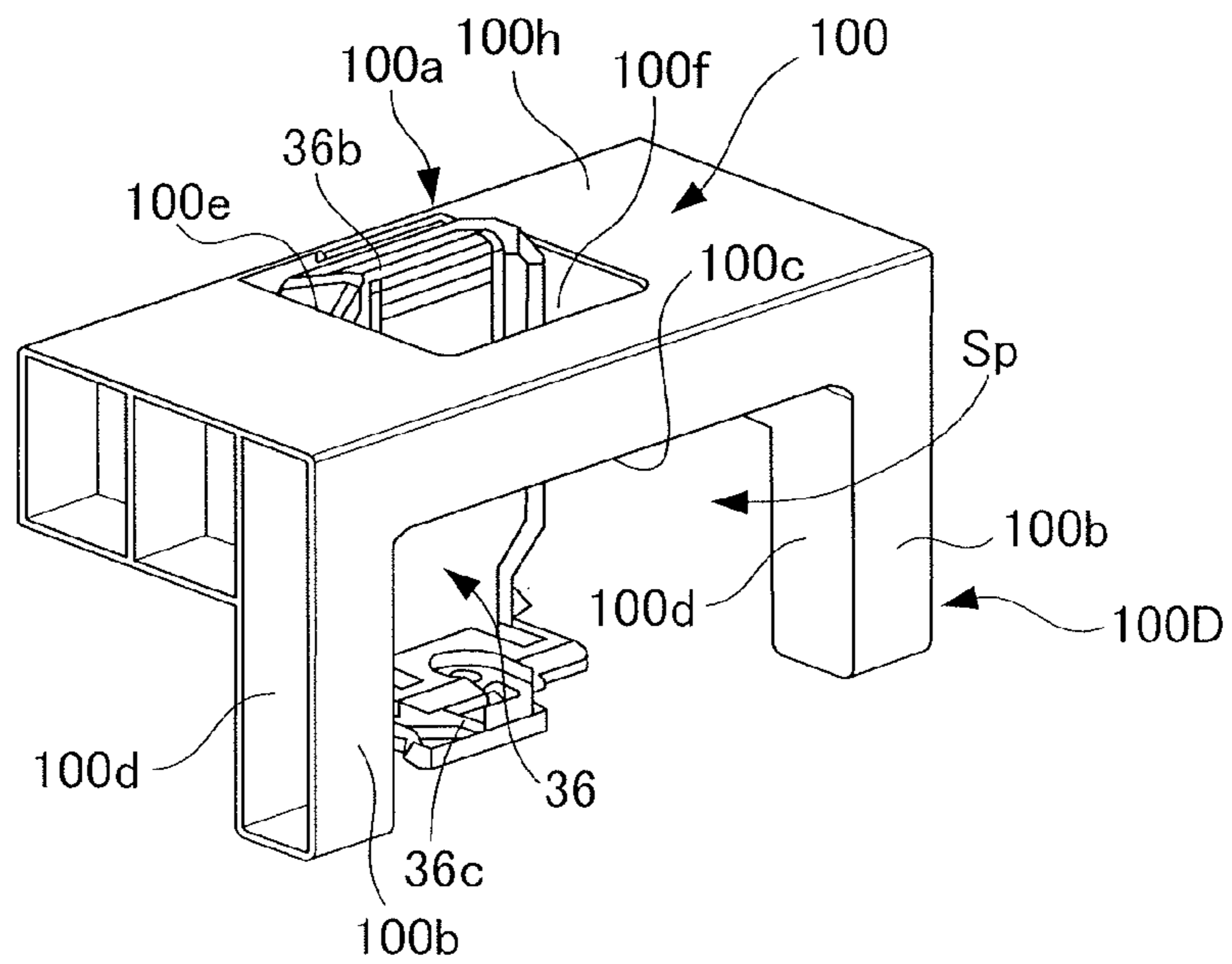


FIG.6A

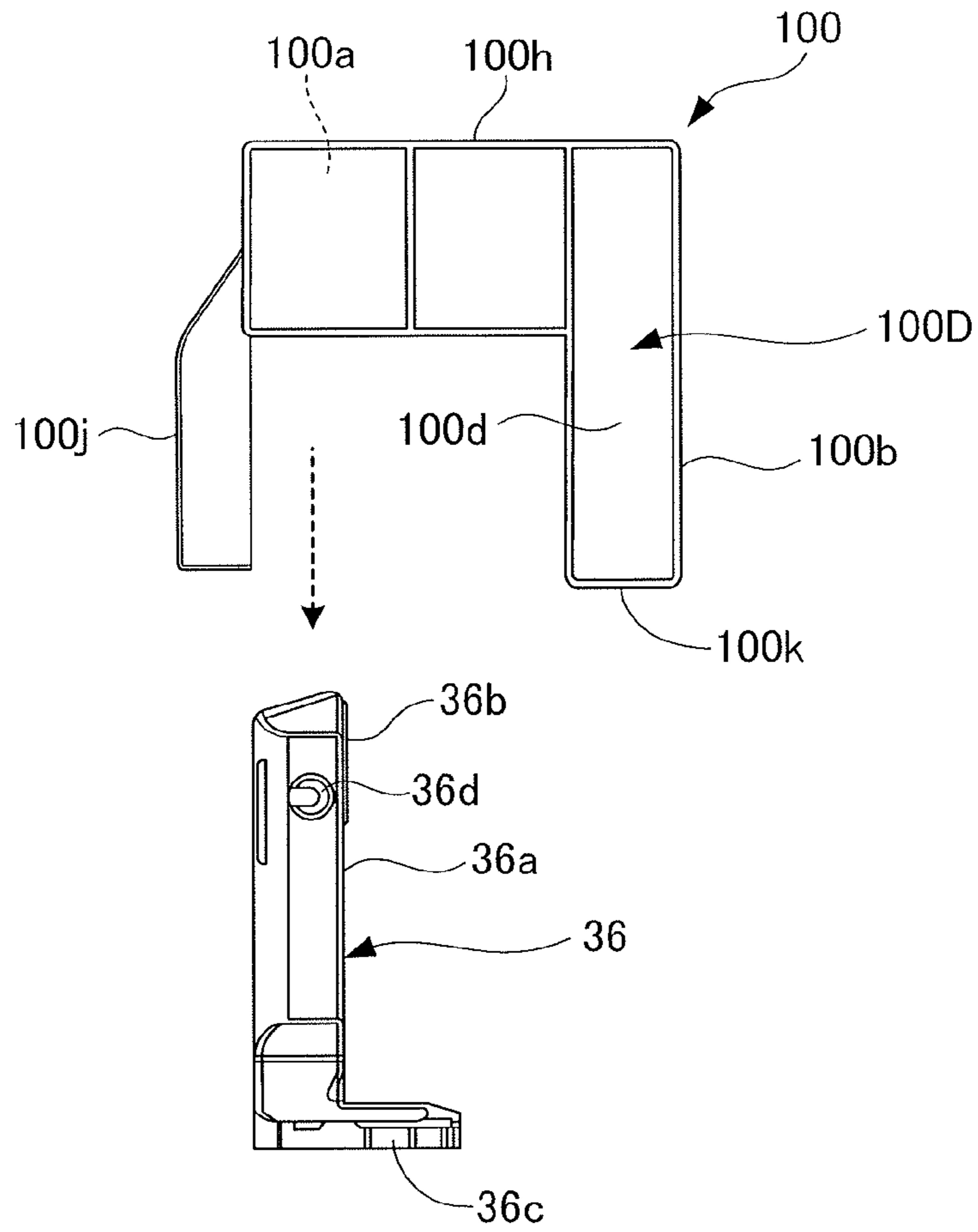


FIG.6B

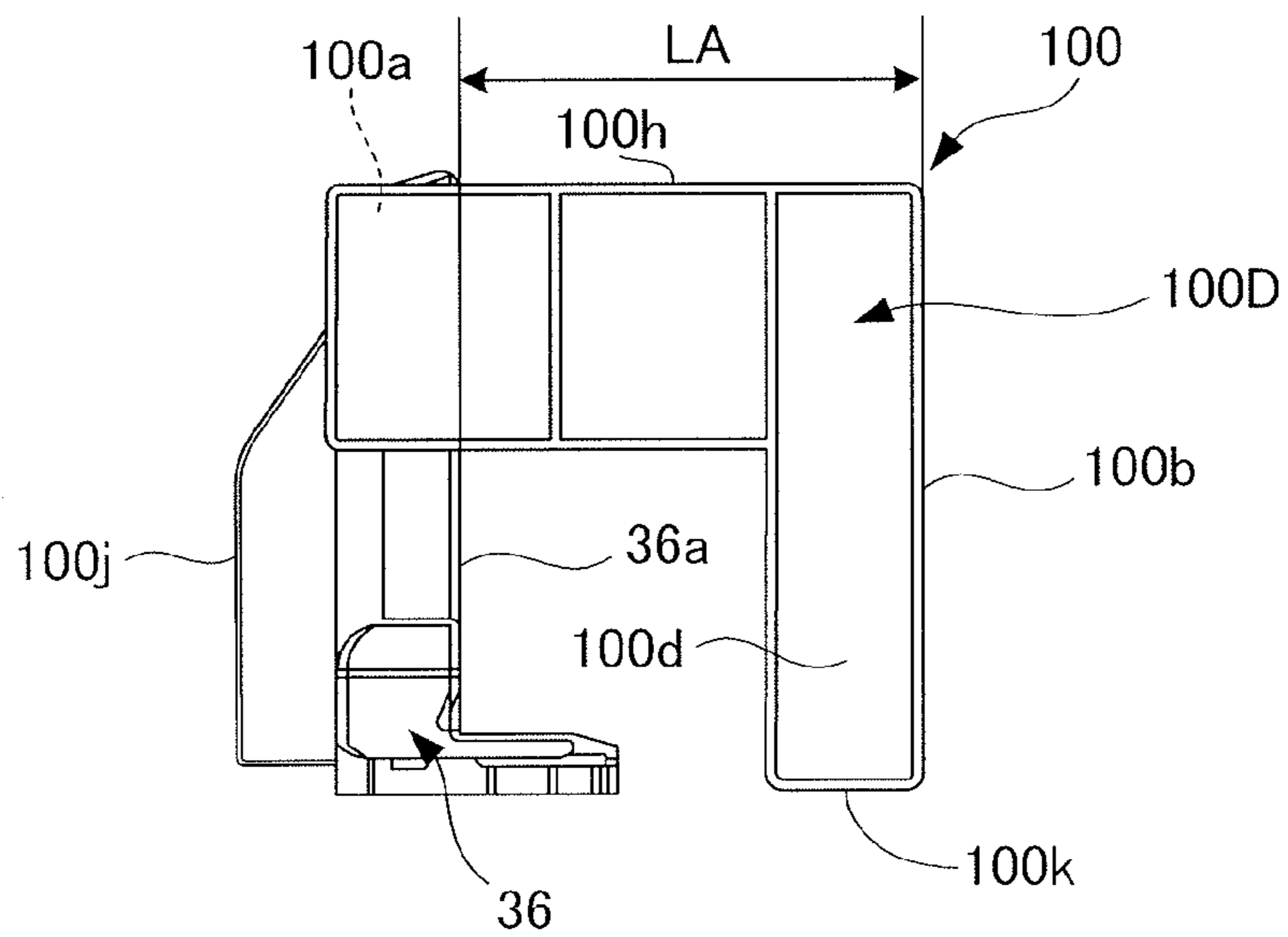


FIG.8A

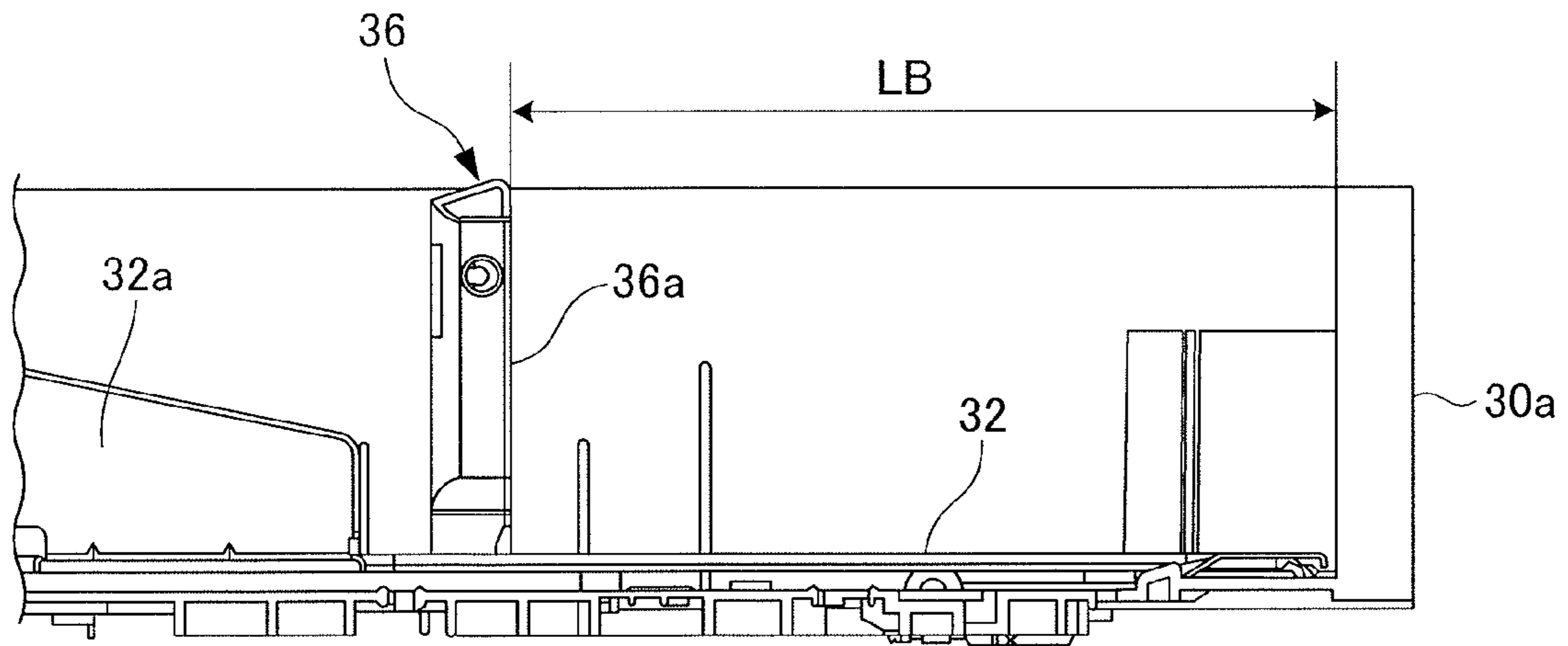


FIG.8B

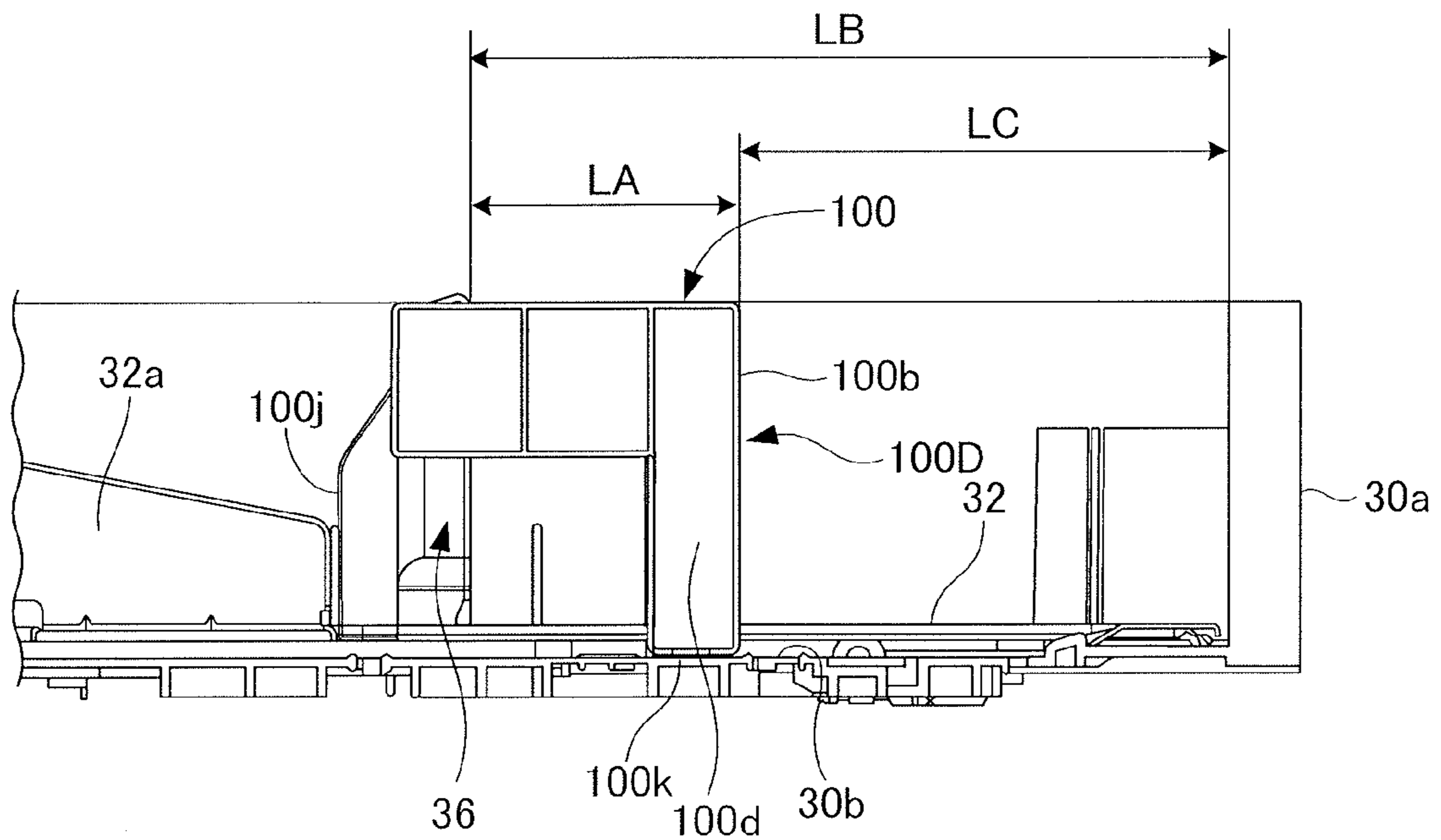


FIG.9A

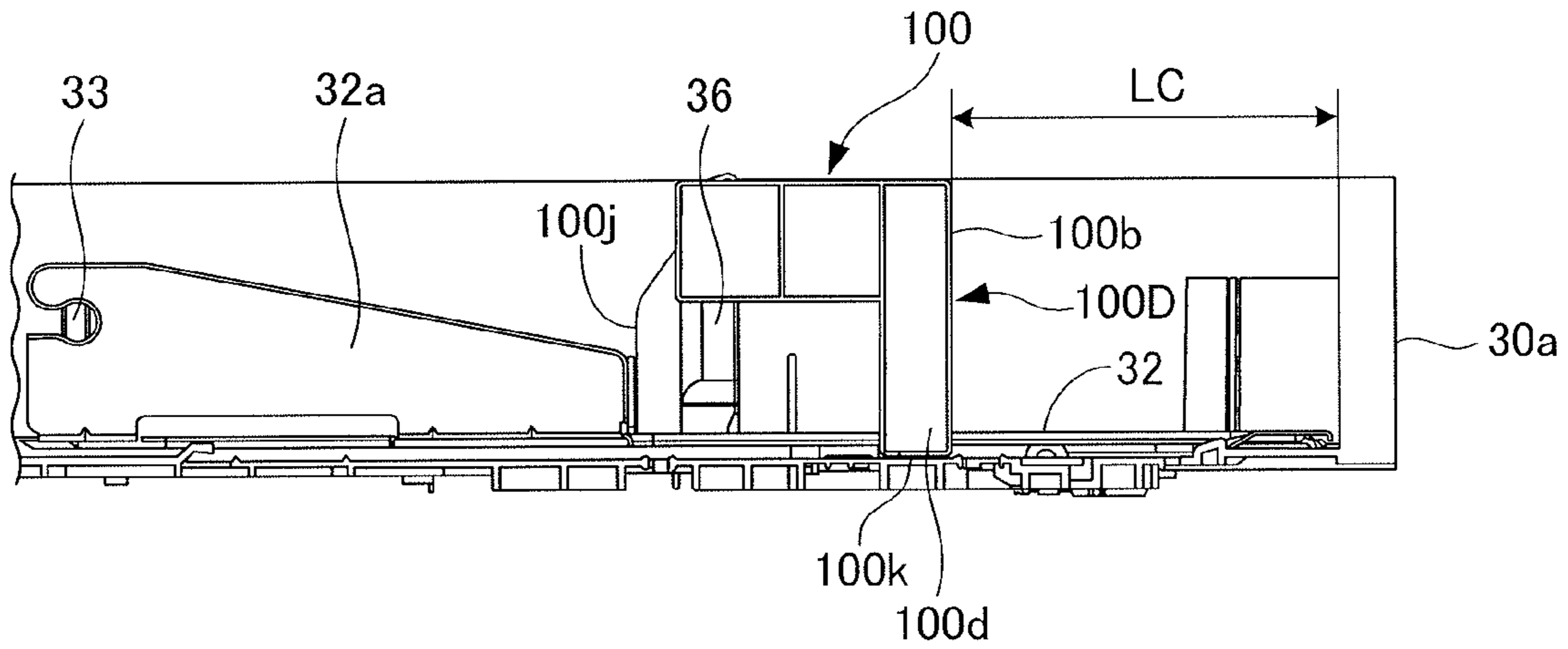


FIG.9B

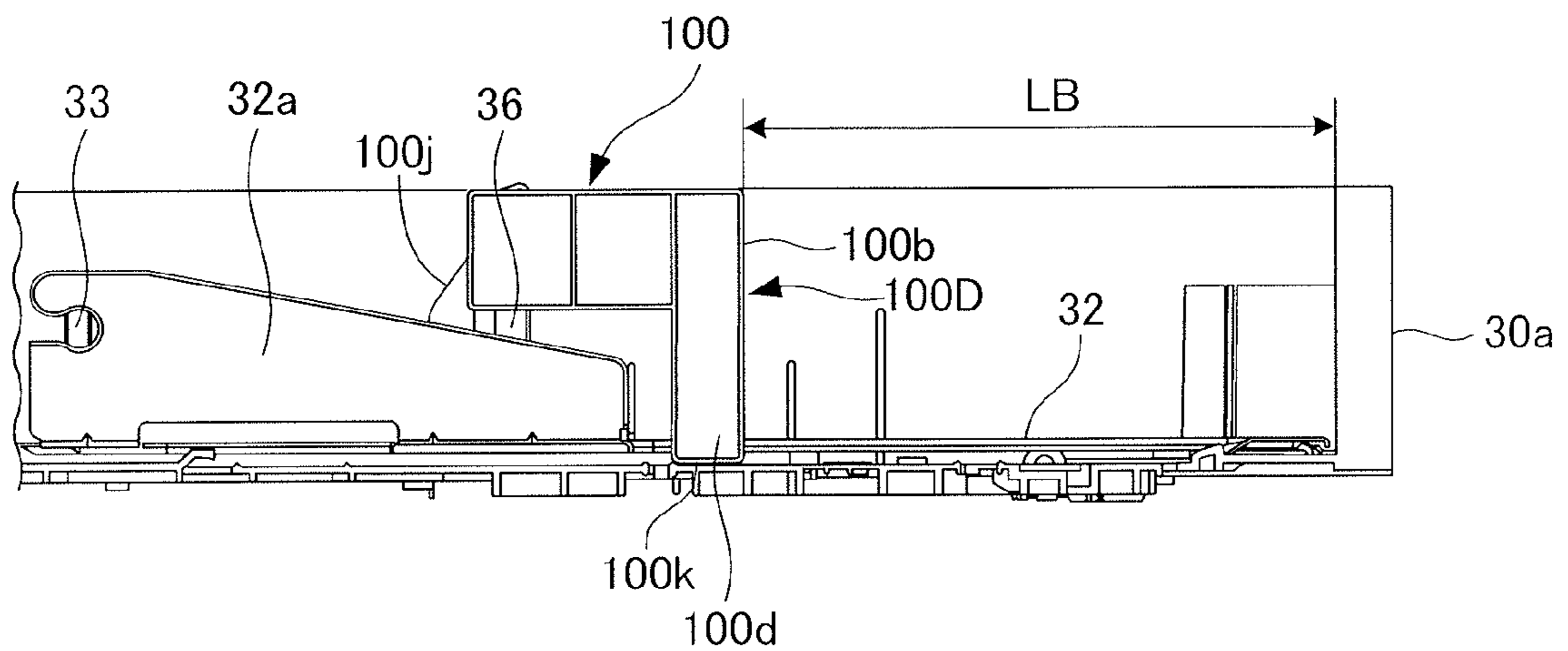


FIG. 10A

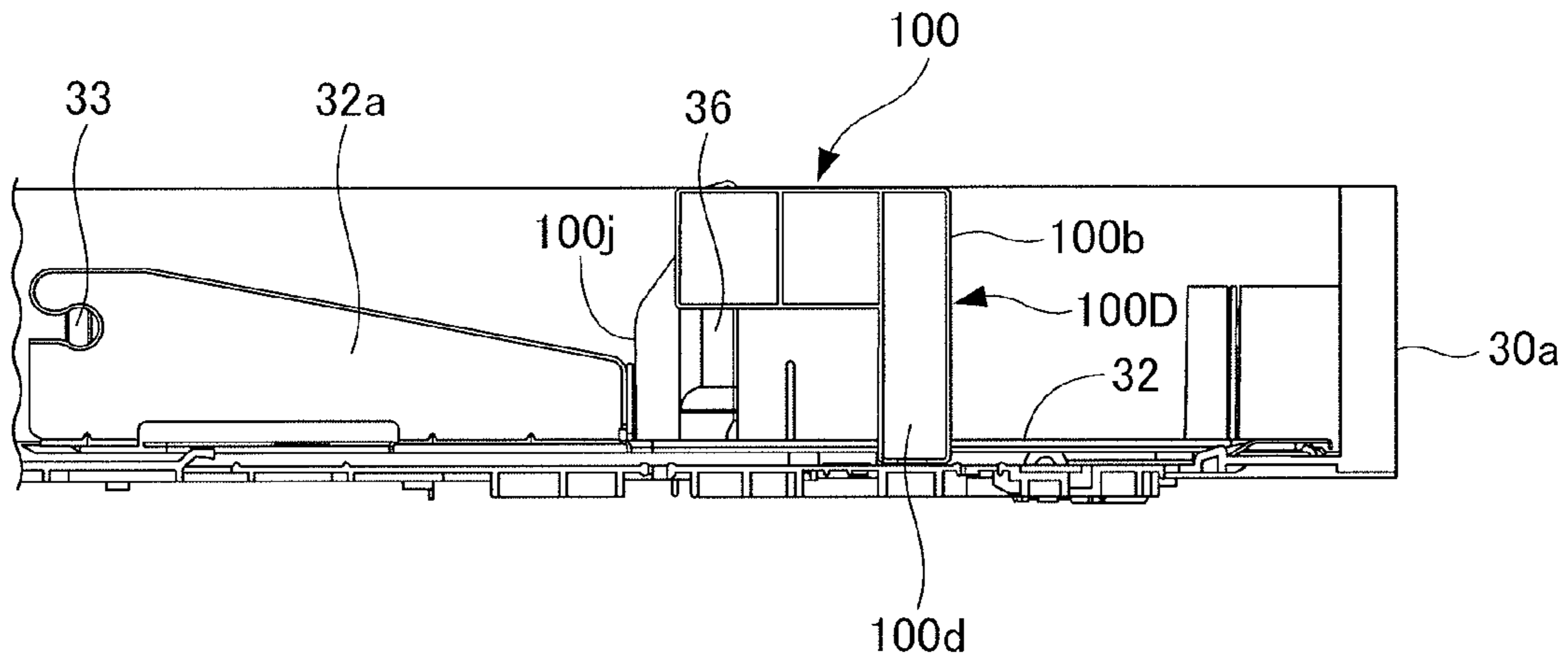
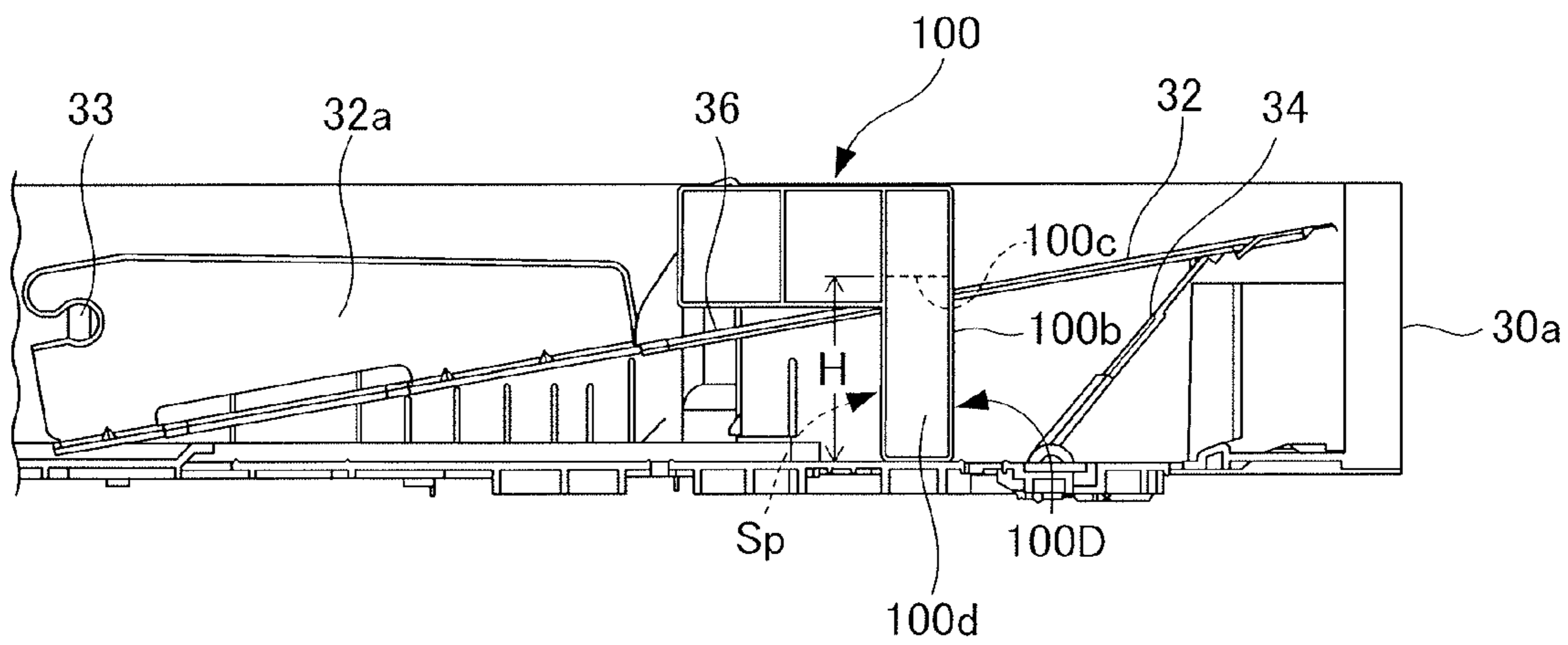


FIG. 10B



SHEET STORAGE APPARATUS AND IMAGE FORMING APPARATUS

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a sheet storage apparatus for storing sheets, and an image forming apparatus including the sheet storage apparatus.

Description of the Related Art

Recently, image forming apparatuses, such as copiers, printers and facsimile machines, having a sheet feeding apparatus are widely used. Such an image forming apparatus feed a sheet with the sheet feeding apparatus to an image forming portion where an image is formed on the sheet. A typical sheet feeding apparatus includes a sheet feed cassette (sheet storage apparatus) that is drawably attached to the apparatus body and stores sheets to be fed to the image forming portion automatically. Some sheet feed cassettes include a sheet stacking portion on which sheets are stacked, and which is arranged to be lifted so that the sheets stacked thereon comes into contact with a sheet feed roller.

The sheet feed cassette having the sheet stacking portion includes a rear end regulation member. The rear end regulation member regulates a position of an upstream end (hereinafter referred to as a rear end), in a sheet feed direction, of the sheet stacked on the sheet stacking portion so as to allow a variety of sheets different in size to be stored in the cassette. Further, the sheet feed cassette is provided with a pair of side end regulation members that regulate a side end position in a direction orthogonal to the sheet feed direction (hereinafter referred to as a width direction).

The pair of side end regulation members of the sheet feed cassette regulates both side ends of the sheets while the rear end regulation member regulates the rear end of the sheets, so that the sheets are always positioned at the predetermined position. Thereby, sheets can always be fed from the same position on the sheet feed cassette stored in the apparatus body, and a stable sheet feeding performance can be achieved.

Meanwhile, there are increasing demands for realizing a large amount of printing on small-sized sheets such as postcards and envelopes. Conventionally, the small-sized sheets such as postcards and envelopes had to be fed through a manual sheet feed portion. Unfortunately, since the amount of sheets that can be stacked in the manual sheet feed portion was restricted to approximately 10 mm height, it was not suitable to perform printing on a large amount of sheets. In order to improve capability of massive printing, a sheet feed cassette allowing small-sized sheets to be stacked on is desirable, so that a large amount of the small-sized sheets are fed from the cassette. But generally, the minimum sheet size (A5 size, for example) that can be regulated using side end regulation members and rear end regulation member is larger than the small-sized sheets. Therefore, this kind of sheet feed cassette could not appropriately regulate the ends of the small-sized sheets smaller than the normally-used minimum sheet size (such as postcards and envelopes) with the side end regulation members and the rear end regulation member.

Here, Japanese Patent Application Laid-Open Publication No. 11-59925 discloses a sheet feed cassette having an auxiliary cassette (second cassette) capable of storing small-sized sheets and being attached to an inner side of a cassette body (first cassette). The second cassette includes a rear end regulation member and side end regulation members disposed at positions corresponding to ends of a sheet among

small-sized sheets such as postcards and envelopes. This second cassette is attached to a sheet stacking portion of the first cassette, which is attached drawably to the apparatus body. This configuration enables the sheet feed cassette to regulate the ends of the small-sized sheet to be fed therefrom.

However, the side end regulation members and the rear end regulation member disclosed in the above document are fixed on the predetermined positions. Therefore, in order to feed multiple kinds of small-sized sheets different in size, it is necessary to prepare various types of second cassettes different in positions of side end regulation members and/or rear end regulation member positions. This configuration necessitates various types of second cassettes, which leads to increase in cost. Furthermore, users might feel inconvenient under this configuration because of time and labor required to select and replace the second cassettes manually each time the size of a small-size sheet in use is changed.

SUMMARY OF THE INVENTION

According to one aspect of the present invention, a sheet storage apparatus includes a storage apparatus body, a sheet stacking portion, a rear end regulation member, and a rear end regulation attachment. The sheet stacking portion has an opening opened in an upward and downward direction, and can move upward and downward with respect to a bottom portion of the storage apparatus body. The rear end regulation member is supported movably on the bottom portion of the storage apparatus body in a sheet feed direction and a direction opposite to the sheet feed direction, and regulates an upstream end position, in the sheet feed direction, of the sheet stacked on the sheet stacking portion. The rear end regulation attachment is detachably attached to the rear end regulation member. The rear end regulation attachment includes a regulating portion extending toward the bottom portion of the storage apparatus body through the opening in a state where the rear end regulation attachment is attached to the rear end regulation member. The regulating portion regulates the upstream end of the sheet on a position downstream, in the sheet feed direction, of a regulating position of the rear end regulation member.

According to another aspect of the present invention, a sheet storage apparatus includes a storage apparatus body, a sheet stacking portion, a side end regulation member, a rear end regulation member, and a rear end regulation attachment. The sheet stacking portion can move upward and downward with respect to a bottom portion of the storage apparatus body. The side end regulation member is supported movably on the bottom portion in a width direction orthogonal to a sheet feed direction, and abuts against an end portion in the width direction of the sheet stacked on the sheet stacking portion. The rear end regulation member is supported movably on the bottom portion in a sheet feed direction and a direction opposite to the sheet feed direction, and includes a main regulating surface abutting against an upstream end, in the sheet feed direction, of the sheet stacked on the sheet stacking portion. The sheet stacking portion includes a side end cutout portion for allowing movement of the side end regulation member and a rear end cutout portion for allowing movement of the rear end regulation member. The rear end regulation attachment is attached in a detachable manner to the rear end regulation member, and includes a subsidiary regulating surface to regulate the upstream end of the sheet. The subsidiary regulating surface is arranged downstream in the sheet feed direction of the main regulating surface of the rear end

regulation member and. The rear end regulation attachment is attached to the rear end regulation member in a condition in which The rear end regulation attachment slidably contact with the bottom portion of the storage apparatus body through the side end cutout portion.

Further features of the present invention will become apparent from the following description of exemplary embodiments with reference to the attached drawings. The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate exemplary embodiments, features, and aspects of the invention and, together with the description, serve to explain the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic cross-sectional view illustrating an image forming apparatus having a sheet feed cassette according to the present embodiment.

FIG. 2A is a perspective view of a sheet feed cassette according to the present embodiment.

FIG. 2B is a cross-sectional view of the sheet feed cassette according to the present embodiment, taken along the line F-F in FIG. 2A and viewed in the arrow direction.

FIG. 3 is a perspective view illustrating a configuration for relative displacement of side end regulation members.

FIG. 4 is a perspective view illustrating a rear end regulation attachment according to the present embodiment.

FIG. 5A is a perspective view illustrating a rear end regulation member and the rear end regulation attachment according to the present embodiment, in a state prior to attaching the rear end regulation attachment to the rear end regulation member according to the present embodiment.

FIG. 5B is a perspective view illustrating a rear end regulation member and the rear end regulation attachment according to the present embodiment, in a state after attaching the rear end regulation attachment of FIG. 5A to the rear end regulation member.

FIG. 6A is a side view illustrating the rear end regulation member and the rear end regulation attachment according to the present embodiment, in a state prior to attaching the rear end regulation attachment to the rear end regulation member.

FIG. 6B is a side view illustrating the rear end regulation member and the rear end regulation attachment according to the present embodiment, in a state after attaching the rear end regulation attachment of FIG. 6A to the rear end regulation member.

FIG. 7 is a perspective view of the sheet feed cassette according to the present embodiment, in a state where the rear end regulation attachment is attached to the rear end regulation member.

FIG. 8A is a side view of the sheet feed cassette according to the present embodiment, in a state where the rear end regulation member from which the rear end regulation attachment is detached is moved to a minimum regulating position.

FIG. 8B is a side view of the sheet feed cassette according to the present embodiment, in a state where the rear end regulation member to which the rear end regulation attachment is attached is moved to the minimum regulating position.

FIG. 9A is a side view of the sheet feed cassette according to the present embodiment, in a state where the rear end regulation member to which the rear end regulation attachment is attached is moved forward.

FIG. 9B is a side view of the sheet feed cassette according to the present embodiment, in a state where the rear end regulation member to which the rear end regulation attachment is attached is moved backward.

FIG. 10A is a side view of the sheet feed cassette according to the present embodiment, in a state where the rear end regulation attachment is attached to the rear end regulation member and a sheet stacking portion is positioned at a lower position.

FIG. 10B is a side view of the sheet feed cassette according to the present embodiment, in the state where the sheet stacking portion is lifted from the lower position illustrated in FIG. 10A.

DESCRIPTION OF THE EMBODIMENTS

Now, an embodiment of the present invention will be described in detail with reference to the drawings. At first, an image forming apparatus having a sheet feed cassette, i.e., a sheet storage apparatus, will be described with reference to FIG. 1. FIG. 1 is a schematic cross-sectional view illustrating a laser beam printer, i.e., an image forming apparatus according to the present embodiment, viewed from a front side.

Image Forming Apparatus

As illustrated in FIG. 1, a full-color laser beam printer (hereinafter referred to as "printer") 1 as an image forming apparatus includes an image forming apparatus body (hereinafter referred to as apparatus body) 1a. The apparatus body 1a includes an image forming portion 28, a fixing portion 20, and an image reading unit 2. The image reading unit 2 is an upper unit arranged substantially horizontally and above the apparatus body 1a. The apparatus body 1a includes a controller 18 for controlling each part of the apparatus.

A discharge space Sa for discharging sheets is formed between the image reading unit 2 and the apparatus body 1a. A toner cartridge 15 is arranged below the discharge space Sa, and a plurality of (four, in the present embodiment) sheet feeding apparatuses 29 are arranged at a lower portion of the apparatus body 1a.

The image forming portion 28 adopts a four-drum full-color system, and includes a laser scanner 10, and four process cartridges 11 for forming toner images of four colors, which are yellow (Y), magenta (M), cyan (C) and black (K).

Each process cartridge 11 include a photosensitive drum 12, i.e., a photosensitive body, a charging unit 13, i.e., a charging means, a developer 14, i.e., a developing means, and a cleaner (not shown), i.e., a cleaning means. Further, the image forming portion 28 includes an intermediate transfer unit 41 arranged above the process cartridges 11.

The intermediate transfer unit 41 includes an intermediate transfer belt 16, i.e., an image bearing member wound around a drive roller 16a, and a tension roller 16b. Further, the intermediate transfer unit 41 includes primary transfer rollers 19 arranged on an inner side of the intermediate transfer belt 16 and abutted against an inner side surface of the intermediate transfer belt 16 at positions opposing to the respective photosensitive drums 12. The intermediate transfer belt 16 is composed of a film-like member, and abutted against the respective photosensitive drums 12. The drive roller 16a that is driven by a drive unit not shown drivingly rotates the intermediate transfer belt 16 in an arrow direction.

On the intermediate transfer belt 16 is applied transfer bias having positive polarity by the primary transfer roller 19. Then, toner images of respective colors, which have

negative polarity, are transferred to the photosensitive drums **12** under the transfer bias. These toner images are sequentially transferred to the intermediate transfer belt **16** in multiple layers. Thereby, a color image is formed on the intermediate transfer belt. At the position opposing to the drive roller **16a** of the intermediate transfer unit **41** is arranged a secondary transfer roller **17** for transferring the color image formed on the intermediate transfer belt onto a sheet P. The drive roller **16a** and the secondary transfer roller **17** pressed against the drive roller **16a** constitute a secondary transfer nip N, i.e., a secondary transfer portion.

The fixing portion **20** is arranged downstream in a sheet conveyance direction from the secondary transfer roller **17**. Above the fixing portion **20** are arranged a first discharge roller pair **25a**, a second discharge roller pair **25b**, and a surface reversing portion **42**, i.e., a reverse discharge portion. The surface reversing portion **42** includes an inverting roller pair **26**, i.e., a sheet reverse conveyance roller capable of bidirectional rotation, and a re-conveyance path R. The re-conveyance path R conveys the sheet that is formed an image on a first surface thereof to the image forming portion **28** again. The image forming portion **28**, the secondary transfer nip N and the fixing portion **20** constitute an image forming unit **27** for forming images on a sheet P fed from the sheet feeding apparatus **29**, which will be described in detail later. The image forming unit **27** forms an image on the sheet P sent from a sheet feed cassette **30**.

With the configuration as described above, an image information read by the image reading unit **2** or entered from an external device such as a personal computer (PC) not shown is subjected to image processing, converted to electrical signals, and transmitted to the laser scanner **10** of the image forming portion **28**.

In the image forming portion **28**, the surfaces of the photosensitive drums **12** in the respective process cartridges **11** are scanned by laser beams emitted from the laser scanner **10**, based on the image information of the respective color components of yellow, magenta, cyan and black. Thereby, the surfaces of the photosensitive drums **12** in the process cartridges **11** are charged evenly to predetermined polarity and potential by the charging units **13**, exposed by the laser scanner **10**, and formed with electrostatic latent images that correspond to respective single-colored images of yellow, magenta, cyan and black.

Thereafter, the electrostatic latent images are developed by the respective colored toners of yellow, magenta, cyan and black to be visualized. The colored toner images developed on the respective photosensitive drums are sequentially transferred and superposed on a preceding colored toner image, to the intermediate transfer belt **16** under primary transfer bias applied to the primary transfer roller **19**. Thereby, a toner image is formed on the intermediate transfer belt **16**.

Meanwhile, the sheet P sent from the sheet feeding apparatuses **29** passes a registration roller pair **40**, and is transferred to the secondary transfer nip N. The registration roller pair **40** abut against the front end (downstream end) of the sheet P. With this configuration, a loop in sheet P is formed while the front end of the sheet P follows the nip portion, and skewing of the sheet P is corrected thereby. At the secondary transfer nip N, the toner images formed on the image forming portion **28** are collectively transferred (secondary-transferred) onto the sheet P.

Thereafter, the sheet P with the secondary-transferred toner image is conveyed to the fixing portion **20**. The fixing portion **20** applies heat and pressure on the sheet P so that the toner image is fixed to the sheet as color image. The

sheet P with a fixed color image is discharged by the first discharge roller pair **25a** to the discharge space Sa, and stacked on a stacking portion **23** of the discharge space Sa. Sheet Feeding Apparatus

Each sheet feeding apparatus **29** includes the sheet feed cassette **30** as an example of a sheet storage apparatus for storing the sheets P, and a sheet conveyance portion **24** for conveying the sheet P stored in the sheet feed cassette **30** toward a drawing roller pair **21** disposed downstream. The sheet conveyance portion **24** is arranged above and downstream in a sheet feed direction from the sheet feed cassette **30**. The sheet conveyance portion **24** includes a pickup roller **62** and a separating roller pair **22** of a feed roller **60** and a retard roller **61**. The pickup roller **62**, i.e., a sheet feeding member, is supported pivotably in an upward and downward direction via a pivotable arm (not shown) around the feed roller **60**. Being pressed against the sheet P stored in the sheet feed cassette **30**, the pickup roller **62** rotates to send out the sheet P.

When image forming operation is started, the sheets P are separated and fed one by one from the sheet feed cassette **30** through the sheet conveyance portion **24**. The pickup roller **62** is arranged above a sheet stacking portion **32** described later (refer to FIG. 2A). Thus, when the sheet stacking portion **32** is lifted, the pickup roller **62** abuts against an uppermost sheet of the sheets P stacked on the sheet stacking portion **32**, and conveys the sheet toward the sheet feed direction (right side of FIG. 1). The sheet P sent out by the pickup roller **62** is conveyed by the feed roller **60**, while the sheets other than the uppermost sheet among overlapped sheets is returned by the retard roller **61** toward the sheet feed cassette **30**.

The sheet P separated and conveyed by the separating roller pair **22** composed of the feed roller **60** and the retard roller **61** is sent further downstream by the drawing roller pair **21**, and conveyed to the registration roller pair **40**. Thereafter, as described above, image is formed on the sheet P, and the sheet is discharged.

Detailed Configuration of the Sheet Feed Cassette

Next, with reference to FIGS. 2A, 2B and 3, a detailed configuration of the sheet feed cassette **30** according to the present embodiment will be described. FIG. 2A is a perspective view of the sheet feed cassette **30**, and FIG. 2B is a cross-sectional view of the sheet feed cassette **30** taken along the line F-F in FIG. 2A and viewed in an arrow direction. Further, FIG. 3 is a perspective view illustrating a configuration for relative displacement of a pair of side end regulation members **35a** and **35b**.

As illustrated in FIGS. 2A and 2B, the sheet feed cassette **30** includes a cassette body **30a** mounted to a front side of the apparatus body **1a** in a drawable manner. The sheet feed cassette **30** is an example of a sheet storage apparatus, and the cassette body **30a** is an example of a storage apparatus body. Within the cassette body **30a** is disposed a support shaft **33** protruding from an inner side wall of the cassette body **30a**. The support shaft **33** supports a pivot support portion **32a** disposed on a plate-like sheet stacking portion **32** (intermediate plate). With this arrangement, the sheet stacking portion **32** with the sheet P on is supported pivotably, in the upward and downward direction (a vertical direction) with respect to a bottom portion **30b** of the cassette body **30a**, around the support shaft **33** as a fulcrum.

Further, a lifter arm **34** for lifting the sheet stacking portion **32** is supported pivotably on the bottom portion **30b** within the cassette body **30a**. When the controller **18** (refer to FIG. 1) drive a motor (not shown), the lifter arm **34** that is transmitted drive force from the motor pivots and pushes

up the sheet stacking portion **32**. Then, based on the detection of a sheet surface detection sensor (not shown), the sheet stacking portion **32** stops pivoting when an upper surface of an uppermost sheet among the sheets stacked on the sheet stacking portion **32** is positioned at a predetermined feeding position.

A pair of side end regulation members **35a** and **35b** regulating end point positions in a width direction of the sheet are arranged in the cassette body **30a**. As illustrated in FIGS. 2A and 2B, a rear end regulation member **36** for regulating a rear end of the sheet is arranged in the cassette body **30a**. As illustrated in FIG. 3, the side end regulation members **35a** and **35b** are coupled with rack gears **37a** and **37b** and a pinion gear **38** positioned between the rack gears and engaged with both gears. This configuration enables the side end regulation members **35a** and **35b** to be relatively displaceable, that is, capable of moving closer to or away from each other.

As illustrated in FIGS. 2A and 2B, side end regulation members **35a** and **35b** and the rear end regulation member **36** are disposed in the sheet feed cassette **30**. Each member among the side end regulation members **35a** and **35b** and the rear end regulation member **36** is slidable with respect to the bottom portion **30b** of the cassette body **30a**. The side end regulation members **35a** and **35b** slide closer to or away from each other along groove-like guide portions **150**. The guide portions **150** are formed as a long cutout in a width direction (direction of arrow E) orthogonal to a sheet feed direction (direction of arrow D) on the bottom portion **30b**. That is to say, the side end regulation members **35a** and **35b** being movable relatively in the width direction (direction of arrow E) are configured to abut against side end of the sheets stacked on the sheet stacking portion **32** and regulate the position of the sheets. Here, an arrow XC denotes a direction parallel to the sheet feed direction (direction of arrow D), an arrow YC denotes a direction parallel to the width direction (direction of arrow E), and an arrow ZC denotes a vertical direction orthogonal to XC and YC.

The sheet stacking portion **32** includes side end cutout portions **32b** and **32c** formed on side portions thereof. The side end cutout portions **32b** and **32c** are configured to allow movement of the respective side end regulation members **35a** and **35b** in the width direction, that is, to form a space in which the side end regulation members **35a** and **35b** can move in the width direction. The side end cutout portions **32b** and **32c** form a space large enough for the side end regulation members to move in the width direction to a position capable of regulating the side ends of a minimum size (such as A5 size) sheet. Here, the "minimum size" represent the smallest size among sheet sizes to be stored in the sheet feed cassette **30** without using a rear end regulation attachment **100**.

The rear end regulation member **36** is supported to slide on the bottom portion **30b** along a groove-like guide portion **151** formed as a long cutout in the sheet feed direction (direction of arrow D) on the bottom portion **30b** of the cassette body **30a**. The sheet stacking portion **32** has a rear end cutout portion **152** formed in the same direction as the guide portion **151** so that the sheet stacking portion **32** does not interfere with the movement of the rear end regulation member **36** when the rear end regulation member **36** is slid.

In other words, the rear end regulation member **36** is guided by the guide portion **151** to be able to move in the sheet feed direction and a direction opposite thereto (opposite direction). The rear end cutout portion **152** forms a space allowing the rear end regulation member **36** to move in the sheet feed direction and the opposite direction, that is to say,

forms a space in which the rear end regulation member **36** can move in the sheet feed direction and the opposite direction. The rear end regulation member **36** includes a main regulating surface **36a** described later, which abuts against a rear end (upstream end) of the sheets P in the sheet feed direction stacked on the sheet stacking portion **32**, regulating the rear end position of the sheets P.

According to the present embodiment, the sheet stacking portion **32** is formed so that the area between the side end cutout portions **32b** and **32c** is relatively narrow in the width direction, and that the rear end cutout portion **152** is formed along the longitudinal direction of the narrow sheet stacking portion **32**.

With the above arrangement, the side end regulation members **35a** and **35b** and the rear end regulation member **36** are capable of sliding within the cassette body **30a**. Therefore, users set positions of above regulation members arbitrarily within the predetermined regulation range depending on the size of the sheet being used, so that the front end position of sheets having an arbitrary size can be constantly regulated to a predetermined position.

It is noted that the regulation range of a rear end of a sheet by the rear end regulation member **36** is set normally as the range for regulating frequently-used sheets. In the present embodiment, the minimum size of a sheet capable of being regulated by the rear end regulation member **36** is determined, for example, to an A5-size. As for sheets of smaller sizes (such as postcards and envelopes), they are not sufficiently regulated by the rear end regulation member **36**. It is conceivable that the range of motion (movable range in the sheet feed direction) of the rear end regulation member **36** is widened so as to enable regulation of small-sized sheets such as postcards and envelopes. With this configuration, however, the rear end cutout portion **152** of the sheet stacking portion **32** needs to be widened. That may lead to deterioration of the rigidity of the sheet stacking portion **32**.

When the rigidity of the sheet stacking portion **32** is deteriorated, there is fear that the sheet stacking portion **32** is deformed. That is to say, the sheet stacking portion **32** lifted by the lifter arm **34** may be deformed under the weight of sheets, which may be a large number of sheets, have a large size (such as A3 size), or have large basis weight (such as a cardboard). In other words, the sheet stacking portion **32** cannot appropriately retain the weight of large-sized sheets. In a case that the sheets have not been lifted to reach a feedable position, feeding failure of the sheets may occur.

The present embodiment solves the above-described problem by attaching the rear end regulation attachment **100** to the rear end regulation member **36** in order to regulate the rear end of small-sized sheets. The details of this arrangement will be described below.

Arrangement of the Rear End Regulation Member and the Rear End Regulation Attachment

The arrangement of the rear end regulation member **36** on which the rear end regulation attachment **100** according to the present embodiment is attached will be described with reference to FIGS. 2A, 4, 5A and 5B. FIG. 4 is a perspective view illustrating the rear end regulation attachment **100** according to the present embodiment. FIG. 5A is a perspective view illustrating a rear end regulation member **36** and the rear end regulation attachment **100** in a state before the rear end regulation attachment **100** is attached to the rear end regulation member **36**. FIG. 5B is a perspective view illustrating a rear end regulation member **36** and the rear end regulation attachment **100** in a state after the rear end regulation attachment **100** of FIG. 5A is attached to the rear end regulation member **36**.

As shown in FIG. 2A and FIGS. 5A and 5B, the rear end regulation member 36 includes the main regulating surface 36a for regulating a rear end of the sheets P stacked on the sheet stacking portion 32, and a pinching portion (pinch portion) 36b capable of pivoting around a pivot shaft 36d. Further, the rear end regulation member 36 includes an engagement portion 36c capable of switching between an engaged state and a non-engaged state. By a pivoting (pinching) operation of the pinching portion 36b, the engagement portion 36c is engaged with and disengaged from a fine irregular portion 151a (rack portion) disposed along the guide portion 151. The engagement portion 36c includes engagement teeth (not shown) that engage with the irregular portion 151a based on the pivoting operation of the pinching portion 36b.

Therefore, the user can engage the engagement portion 36c to the irregular portion 151a by operating the pinching portion 36b, to thereby lock the rear end regulation member 36 to the cassette body 30a. Further, by separating the engagement portion 36c from the irregular portion 151a, the user can release the lock of the rear end regulation member 36 and move the rear end regulation member 36. The pinching portion 36b, the engagement portion 36c and the irregular portion 151a constitute a lock mechanism 36F (rear lock mechanism) for locking the rear end regulation member 36. A lock mechanism (side lock mechanism) for locking the side end regulation members 35a and 35b, which abut against the ends of the sheets, is also provided in the sheet storage apparatus. This lock mechanism for the side end regulation members is arranged similarly as the lock mechanism of the rear end regulation member.

Next, an arrangement of a rear end regulation attachment 100 will be described with reference to FIG. 4, FIGS. 5A and 5B and FIGS. 6A and 6B. FIGS. 6A and 6B are side views of the rear end regulation member and the rear end regulation attachment according to the present embodiment, FIG. 6A illustrating a state prior to attaching the rear end regulation attachment 100 to the rear end regulation member 36, and FIG. 6B illustrating a state where the rear end regulation attachment 100 of FIG. 6A is attached to the rear end regulation member 36.

As illustrated in FIGS. 5A and 5B, the rear end regulation attachment 100 includes a base 100h, and a regulating portion 100D. The regulating portion 100D is an example of a regulating portion and composed of a pair of leg portions 100d and 100d (first regulating portion and second regulating portion). The base 100h has a mounting portion 100a in which a substantially rectangular mounting hole is formed. The mounting hole is configured to be engaged with (fit to) the rear end regulation member 36 from above, in attaching the attachment. The shape of the mounting hole is not restricted to a rectangle and applicable with other shapes such as a semicircle and a triangle. Such a mounting hole should be shaped as the mounting portion 100a fit to (is attachable to) the rear end regulation member 36, and is configured preferably to reserve an operation space 100f described later. In the state where the mounting portion 100a of the rear end regulation attachment 100 is attached to the rear end regulation member 36, the rear end regulation attachment 100 moves integrally with the rear end regulation member 36.

As illustrated in FIGS. 6A and 6B, the base 100h extends from the mounting portion 100a toward the sheet feed direction (right side in the drawing), and supports the regulating portion 100D at a downstream end in the sheet feed direction. Therefore, in the state where the rear end regulation attachment 100 is attached to the rear end regu-

lation member 36, the leg portions 100d and 100d are arranged downstream in the sheet feed direction than the main regulating surface 36a of the rear end regulation member 36. The leg portions 100d and 100d of the rear end regulation attachment 100 in an attached state, extend downward via a cutout (opening) formed by the side end cutout portions 32b and 32c, and abuts against an upper surface of the bottom portion 30b of the cassette body 30a at lower end portions 100k and 100k.

According to the present embodiment, the side end cutout portions 32b and 32c are utilized as openings formed through the sheet stacking portion 32 for arranging the regulating portion 100D. It is also possible to provide an opening that opens in the upward and downward direction separately from the side end cutout portions 32b and 32c, and have the regulating portion 100D arranged therein. In that case, similar to the side end cutout portion according to the present embodiment, it is preferable that the opening is formed to at least extend in the sheet feed direction so as to allow movement of the rear end regulation attachment 100 to the sheet feed direction and the direction opposite thereto. Further, the number of leg portions constituting the regulating portion 100D can be one, or more than three, depending on the arrangement of the apparatus.

The leg portions 100d and 100d respectively have subsidiary regulating surfaces 100b and 100b at side surfaces, downstream in the sheet feed direction, for regulating a rear end of small-sized sheets stacked on the sheet stacking portion 32. In other words, the regulating portion 100D has subsidiary regulating surfaces 100b and 100b arranged downstream in the sheet feed direction from the main regulating surface 36a in a state where the regulating portion is attached to the rear end regulation member 36. That is, with the subsidiary regulating surfaces 100b and 100b, the rear end regulation attachment 100 is capable of regulating the rear end (upstream end in the sheet feed direction) of a small-sized sheet, which has a shorter length in the sheet feed direction than the sheets being regulated by the main regulating surface 36a of the rear end regulation member 36 that is moved to the most downstream side. The subsidiary regulating surfaces 100b and 100b do not have to be disposed integrally with the leg portions 100d and 100d, and can be disposed separately from the leg portions 100d and 100d.

Further, as illustrated in FIG. 6A, the rear end regulation attachment 100, which is attached to the rear end regulation member 36, includes a support portion 100j extended in the vertical direction on the upstream in the sheet feed direction. The support portion 100j guides the rear end regulation attachment 100 to move along a rear end portion (back portion) of the rear end regulation member 36 when the rear end regulation attachment 100 illustrated in FIG. 6A is lowered from above to fit the mounting portion 100a to the rear end regulation member 36. The support portion 100j is formed shorter than the leg portions 100d and 100d in the vertical direction.

As shown in FIGS. 5A and 5B, the size of the mounting hole formed in the mounting portion 100a is set greater than the size of the rear end regulation member 36 viewed from above. The rear end regulation attachment 100 being attached to the rear end regulation member 36 is at a biased position toward the upstream side (rear side) in the sheet feed direction. With this configuration, an operation space 100f is formed on the downstream side (front side) in the sheet feeding direction of the mounting hole, allowing the pinching portion 36b positioned on the inner side of the mounting hole to be pinched by fingers. As shown in FIG.

5A, the rear end regulation attachment 100 includes a support surface 100e supporting the both side surfaces and rear surface of the rear end regulation member 36 fit to the mounting hole of the mounting portion 100a. On the outer side of the support surface 100e is positioned the support portion 100j illustrated in FIGS. 6A and 6B, which is arranged to face on the rear surface of the rear end regulation member 36 illustrated in FIG. 4.

As shown in FIGS. 4 and 5, locking projections 100g are formed on the mounting portion 100a protruding from both width-direction sides to the inner side of the mounting hole in the mounting portion 100a, and extending in the vertical direction between the support surface 100e and the operation space 100f.

The rear end regulation member 36 is engaged to the rear side of the mounting hole formed in the mounting portion 100a. The rear surface and both side surfaces of the rear end regulation member 36 are supported by the support surface 100e as illustrated in FIG. 5B, while both side surfaces being pressed to hold by the locking projections 100g. Therefore, in regulating the rear end of the sheet S by the subsidiary regulating surface 100b, the rear end regulation attachment 100 is prevented from being displaced with respect to the rear end regulation member 36.

On the base 100h of the rear end regulation attachment 100 is disposed a connecting portion 100c positioned between leg portions 100d and 100d, which are arranged at different positions in the width direction. The connecting portion 100c connects the upper portion of the leg portions 100d and 100d. The connecting portion 100c is positioned above the sheet stacking portion 32 that is so lifted that the pickup roller 62 abuts against an uppermost sheet of the sheets stacked on the sheet stacking portion 32 (refer to FIG. 10B). Therefore, the area surrounded by the leg portions 100d and 100d and the connecting portion 100c constitute a movement space Sp in which the sheet stacking portion 32 can be lifted.

Accordingly, as illustrated in FIG. 4, the height from the lower ends of the leg portions 100d and 100d to the connecting portion 100c is set a height dimension H. As illustrated in FIG. 5B, the height dimension H is such a height that the connecting portion 100c attached to the rear end regulation member 36 does not interfere with the lifting operation of the sheet stacking portion 32, which is lifted to a predetermined feeding position (refer to FIG. 10B).

As illustrated in FIG. 5B, the side surface of the base 100h downstream in the sheet feed direction is arranged at a same position as the subsidiary regulating surface 100b of the leg portion 100d in the sheet feed direction, and is formed continuously with the subsidiary regulating surface 100b. Therefore, the base 100h together with the leg portion 100d (regulating portion 100D) constitutes a portion of the regulating surface capable of abutting against a rear end of the sheets P stacked on the sheet stacking portion 32.

While the above-described rear end regulation attachment 100 is attached to the rear end regulation member 36, which is projected upward through the rear end cutout portion 152, the pair of the leg portions 100d and 100d abut against the bottom portion 30b in a lower end portion 100k in such a manner that the pair of the leg portions 100d straddle the sheet stacking portion 32 (refer to FIGS. 9A and 9B). That is, the rear end regulation attachment 100 attached to the rear end regulation member 36 is supported in three places, the mounting portion 100a and the lower end portions 100k of the leg portions 100d, respectively on the rear end regulation member 36 and the bottom portion 30b of the cassette body 30a. Thereby, the rear end regulation attachment 100 is

moved stably together with the rear end regulation member 36 while sliding the lower end portion against the upper surface of the bottom portion 30b of the cassette body 30a.

When the rear end regulation attachment 100 is attached to the rear end regulation member 36, as illustrated in FIGS. 6A and 6B, the subsidiary regulating surface 100b is arranged at a position downstream of the main regulating surface 36a by a predetermined length LA.

Next, the details of the sheet feed cassette 30 with the rear end regulation attachment 100 being attached to the rear end regulation member 36 will be described with reference to FIGS. 7, 8A and 8B. FIG. 7 is a perspective view of the sheet feed cassette according to the present embodiment, with the rear end regulation attachment 100 attached to the rear end regulation member 36. FIG. 8A illustrates a side view of the sheet feed cassette with the rear end regulation member 36 being detached the rear end regulation attachment 100 from and moved to a minimum regulating position (regulating position at the downstream end). FIG. 8B is a side view of the sheet feed cassette with the rear end regulation attachment 100 being attached to the rear end regulation member 36 and positioned at the minimum regulating position.

As described above with reference to FIG. 6, the subsidiary regulating surface 100b of the rear end regulation attachment 100 that is attached to the rear end regulation member 36 is positioned downstream in the sheet feed direction by the length LA from the main regulating surface 36a of the rear end regulation member 36 before attachment. Therefore, as illustrated in FIG. 8B, the minimum regulating dimension LC with the attachment is shorter by length LA than the minimum regulating dimension LB, the lower limit of the regulation range of the rear end regulation member 36 without the attachment (illustrated in FIG. 8A). Thereby, according to the present embodiment, it becomes possible to regulate the rear end of sheets of a minimum regulating dimension LC in length, which is shorter than the minimum regulating dimension LB under the configuration illustrated in FIG. 8A, where the sheets are regulated by the rear end regulation member 36, by length LA.

Now, it will be described with reference to FIGS. 9A and 9B that the rear end regulation attachment 100 attached to the rear end regulation member 36 moves along with the movement of the rear end regulation member 36. FIG. 9A is a side view of the sheet feed cassette 30, of which the rear end regulation member 36 with the rear end regulation attachment 100 is moved forward. FIG. 9B is a side view of the sheet feed cassette 30, of which the rear end regulation member 36 with the rear end regulation attachment 100 is moved backward.

As illustrated in FIGS. 9A and 9B, the rear end regulation attachment 100, being attached to the rear end regulation member 36, moves backward together with the rear end regulation member 36. When the rear end regulation member 36 is moved to the backward end, the rear end regulation attachment 100 is at such a position that allows the apparatus to storage the sheets of or shorter than the minimum regulating dimension LB in length (See FIG. 9B). With this configuration, the sheet storage feed 30 is applicable for a sheet having an arbitrary dimension between the minimum regulating dimension LB, the minimum size in regulating with the rear end regulation member 36, and the minimum regulating dimension LC, the minimum size in regulating with the rear end regulation attachment 100 attached to the rear end regulation member 36. That is, by moving the rear end regulation member 36, the rear end of such a sheet is sufficiently regulated by the rear end regulation attachment 100.

Now, lifting operation of the sheet stacking portion **32** will be described with reference to FIGS. **7**, **10A**, and **10B**, which is performed after the rear end regulation attachment **100** is attached to the rear end regulation member **36**. FIG. **10A** is a side view of the sheet feed cassette **30** of which the sheet stacking portion **32** is not lifted yet, with the rear end regulation attachment **100** being attached to the rear end regulation member **36**. FIG. **10B** is a side view of the sheet feed cassette **30** of which the sheet stacking portion **32** is lifted from the position illustrated in FIG. **10A**.

As illustrated in FIG. **7**, in a state where the rear end regulation attachment **100** is attached to the rear end regulation member **36**, the sheet stacking portion **32** is positioned within the movement space *Sp* between the pair of subsidiary regulating surfaces **100b** and **100b** aligned in the width direction. Thereby, the rear end regulation attachment **100** is stably abutted, in a slidable manner, on the upper surface of the bottom portion **30b** of the cassette body **30a** in the sheet feed cassette **30**, instead of on the sheet stacking portion **32**.

Now, some operations for loading sheets *P* into the sheet feed cassette **30** will be described. At first, if the sheet size is equal to or greater than a minimum size (such as A5 size) that can be regulated by the rear end regulation member **36**, the user places the sheets on the sheet stacking portion **32** while keeping the side end regulation members **35a** and **35b** and the rear end regulation member **36** on an outer-wall side of the cassette body **30a**. Then, the user moves the side end regulation members **35a** and **35b** and the rear end regulation member **36** to a position corresponding to the side end positions and the rear end position of the sheets. In another example, the user moves the side end regulation members **35a** and **35b** and the rear end regulation member **36** in advance to a position corresponding to the size of the sheets to be loaded, and to place the sheets from above onto the sheet stacking portion **32**. In this manner sheets having a size equal to or greater than the minimum sheet size (such as A5 size) are loaded into the sheet feed cassette **30** and regulated position thereof.

On the other hand, the user attaches the rear end regulation attachment **100** to the rear end regulation member **36** in loading small-sized sheets, which are smaller than the minimum size capable of being regulated by the rear end regulation member **36** (such as postcards and envelopes), to the sheet feed cassette **30**. Then, the user places the small-sized sheets to the sheet stacking portion **32**, and moves the side end regulation members **35a** and **35b** and the rear end regulation member **36**. The user regulates the ends in the width direction of the sheets by the side end regulation members **35a** and **35b**, while regulating the rear ends of the sheets with the rear end regulation attachment **100** attached to the rear end regulation member **36**. In this manner, small-sized sheets, which are smaller than the minimum size sheet (such as A5 size), are loaded into the sheet feed cassette **30** and sufficiently regulated position thereof. It is noted that various types of small-sized sheets having different dimensions in the sheet feed direction and/or the width direction may be loaded. Thus, the user moves the side end regulation members **35a** and **35b** and the rear end regulation member **36** to abut against the ends of stacked sheets depending on the dimension of the sheets, so as to regulate the side ends and the rear end of the sheet among the various types of sheets.

By the way, it is a conceivable arrangement that the rear end regulation attachment **100** is supported by the sheet stacking portion **32**, by placing the rear end regulation attachment **100** on the sheet stacking portion **32**, for example. But such an arrangement may lead to inconve-

nience as following. When the sheet stacking portion **32** is pivoted around a fulcrum of the support shaft **33** in moving the uppermost surface of the sheet to a feedable position for the pickup roller **62** (refer to FIG. **1**), the rear end regulation attachment **100** is lifted up along with the pivoting of the sheet stacking portion **32**. Lifting of the rear end regulation attachment **100** along with the lifting of the sheet stacking portion **32** necessitates increase in size of the apparatus body **1a** because of preventing interference between the upper surface of the rear end regulation attachment **100** and the apparatus body **1a** resulting in increase in size of the printer **1**.

In contrast, according to the present embodiment, as illustrated in FIG. **10A**, the rear end regulation attachment **100** is supported on the bottom portion **30b** of the sheet feed cassette **30**, instead of on the sheet stacking portion **32**. Furthermore, as illustrated in FIG. **10B**, the sheet stacking portion **32** being lifted moves within the movement space *Sp* formed by the rear end regulation attachment **100**. With this configuration, moving of the sheet stacking portion **32** is not interfered with the rear end regulation attachment **100** that is assembled into the sheet feed cassette **30**. Thereby, pivoting of the sheet stacking portion **32** is enabled without increase in size of the apparatus. It is noted that the height dimension *H* of the rear end regulation attachment **100** is set to such a height that the attachment does not interfere with the sheet stacking portion **32** lifted to a predetermined sheet feeding position. Therefore, lifting of the rear end regulation attachment **100** along with the pivoting of the sheet stacking portion **32** as mentioned above does not occur.

As described above, according to the present embodiment, small-sized sheets such as postcards and envelopes are fed with the rear end regulation attachment **100** that is easily attached to and removed from the rear end regulation member **36**. Since it is not required to widen the area of cutout of the rear end cutout portion **152**, regulation of the rear end of small-sized sheets is carried out appropriately without deteriorating the rigidity of the sheet stacking portion **32**. With this configuration, the sheet feed cassette **30** stores a large amount of small-sized sheets so that the sheets are fed stably therefrom.

Further, the rear end regulation attachment **100** slides together with the rear end regulation member **36** within the sheet feed cassette **30**. Thereby, a variety of sheets different in size are inclusively and stably regulated with the rear end regulation attachment **100**. This arrangement eliminates the need for troublesome operations required in conventional arts, such as replacing attachments every time the sheet size is changed.

While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.

This application claims the benefit of Japanese Patent Application Nos. 2015-002108, filed on Jan. 8, 2015, and 2015-239301, filed on Dec. 8, 2015, which are hereby incorporated by reference herein in their entirety.

What is claimed is:

1. A sheet storage apparatus comprising:
 - a storage apparatus body;
 - a sheet stacking portion on which a sheet is stacked, the sheet stacking portion configured to be movable upward and downward with respect to a bottom portion

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- of the storage apparatus body, the sheet stacking portion having an opening opened in an upward and downward direction;
- a rear end regulation member supported movably on the bottom portion in a sheet feed direction and a direction opposite to the sheet feed direction, the rear end regulation member configured to regulate a position of an upstream end, in the sheet feed direction, of the sheet stacked on the sheet stacking portion;
- a side end regulation member configured to regulate an end position, in a width direction orthogonal to the sheet feed direction, of the sheet stacked on the sheet stacking portion, the side end regulation member being movable in the width direction within a space formed by the opening; and
- a rear end regulation attachment being detachably attached to the rear end regulation member, the rear end regulation attachment comprising a regulating portion extending toward the bottom portion of the storage apparatus body through the opening in a state where the rear end regulation attachment is attached to the rear end regulation member, and regulating the upstream end of the sheet on a position downstream, in the sheet feed direction, of a regulating position of the rear end regulation member.
2. The sheet storage apparatus according to claim 1, wherein a rear end cutout portion is formed with the sheet stacking portion, the rear end cutout portion forming a space in which the rear end regulation member moves in the sheet feed direction and the opposite direction.
3. The sheet storage apparatus according to claim 1, further comprising a guide portion disposed on the bottom portion of the storage apparatus body and guiding the rear end regulation member to the sheet feed direction and the opposite direction,
- wherein the opening of the sheet stacking portion extends at least in the sheet feed direction such that the rear end regulation attachment is capable of moving in the sheet feed direction while being in contact with the bottom portion, with a movement of the rear end regulation member along the guide portion.
4. The sheet storage apparatus according to claim 1, wherein
- the rear end regulation attachment comprises a base configured for engaging with the rear end regulation member, and
- the base engaged with the rear end regulation member extends downstream in the sheet feeding direction from the rear end regulation member, and supports the regulating portion with a downstream end portion of the base.
5. The sheet storage apparatus according to claim 4, wherein
- the regulating portion comprises a first regulating portion and a second regulating portion arranged at different positions from each other in the width direction orthogonal to the sheet feed direction,
- the base connects with the first regulating portion and the second regulating portion at positions above the sheet stacking portion, and
- the first regulating portion, the second regulating portion, and the base constitutes a regulating surface against which the upstream end of the sheet stacked on the sheet stacking portion abuts.
6. The sheet storage apparatus according to claim 4, further comprising

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- a sheet feeding member disposed above the sheet stacking portion and feeding an uppermost sheet, which abuts against the sheet feeding member, of the sheets stacked on the sheet stacking portion being lifted, wherein a position of the base of the rear end regulation attachment is higher than a position of the sheet stacking portion upon the sheet feeding member abutting against the uppermost sheet.
7. The sheet storage apparatus according to claim 1, further comprising a lock mechanism configured to lock the rear end regulation member at positions corresponding to respective sizes of the sheets different in size.
8. The sheet storage apparatus according to claim 7, wherein
- the lock mechanism comprising a pinch portion to be pinched for releasing lock of the rear end regulation member, and
- the rear end regulation attachment is attached to the rear end regulation member such that an operation space for operating the pinch portion is formed between the rear end regulation attachment and the rear end regulation member.
9. An image forming apparatus comprising:
- the sheet storage apparatus according to claim 1; and
- an image forming unit forming an image on a sheet conveyed from the sheet storage apparatus.
10. A sheet storage apparatus comprising:
- a storage apparatus body;
- a sheet stacking portion, on which a sheet is stacked, configured to be movable upward and downward with respect to a bottom portion of the storage apparatus body;
- a side end regulation member supported movably on the bottom portion in a width direction orthogonal to a sheet feed direction, and abutting against an end portion in the width direction orthogonal to a sheet feed direction of the sheet stacked on the sheet stacking portion;
- a rear end regulation member supported movably on the bottom portion in a sheet feed direction and a direction opposite to the sheet feed direction, and comprising a main regulating surface abutting against an upstream end in the sheet feed direction of the sheet stacked on the sheet stacking portion; and
- a rear end regulation attachment detachably attached to the rear end regulation member and comprising a subsidiary regulating surface, the subsidiary regulating surface arranged downstream, in the sheet feed direction, of the main regulating surface and configured to regulate the upstream end of the sheet,
- wherein the sheet stacking portion has a side end cutout portion for allowing movement of the side end regulation member and a rear end cutout portion for allowing movement of the rear end regulation member, and
- wherein the rear end regulation attachment is attached to the rear end regulation member in a condition in which the rear end regulation attachment slidably contacts with the bottom portion of the storage apparatus body through the side end cutout portion.
11. The sheet storage apparatus according to claim 10, wherein the rear end regulation attachment comprises an attaching portion for attaching the rear end regulation attachment to the rear end regulation member and a leg portion being slidably in contact with the bottom portion of the storage apparatus body, and forms a movement space allow-

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ing lifting of the sheet stacking portion in a state where the rear end regulation attachment is attached to the rear end regulation member.

12. The sheet storage apparatus according to claim 11, wherein the leg portion of the rear end regulation attachment constitutes at least a part of the subsidiary regulating surface.

13. The sheet storage apparatus according to claim 10, further comprising a rear lock mechanism configured to lock the rear end regulation member.

14. A sheet storage apparatus comprising:

a storage apparatus body;

a sheet stacking portion, on which a sheet is stacked, configured to be movable upward and downward with respect to a bottom portion of the storage apparatus body;

a rear end regulation member supported movably on the bottom portion in a sheet feed direction and a direction opposite to the sheet feed direction, the rear end regulation member being configured to regulate a position of an upstream end, in the sheet feed direction, of the sheet stacked on the sheet stacking portion;

a side end regulation member supported movably on the bottom portion in a width direction orthogonal to a sheet feed direction, the side end regulation member being configured to regulate an end position in the width direction orthogonal to a sheet feed direction of the sheet stacked on the sheet stacking portion; and

a rear end regulation attachment detachably attached to the rear end regulation member and comprising a regulating portion configured to regulate the upstream end of the sheet on a position downstream, in the sheet feed direction, of a regulating position of the rear end regulation member in a state where the rear end regulation attachment is attached to the rear end regulation member,

wherein, when viewed from above, in a state where the rear end regulation member with the rear end regulation

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attachment on is positioned at the most downstream position in the sheet feed direction, the regulating portion of the rear end regulation attachment is located at a position overlapping a space in which the side end regulation member is movable in the width direction orthogonal to a sheet feed direction in a state where the rear end regulation attachment is detached from the rear end regulation member.

15. The sheet storage apparatus according to claim 14, wherein

the regulating portion comprises a first regulating portion and a second regulating portion arranged at different positions from each other in the width direction orthogonal to a sheet feed direction,

the rear end regulation attachment comprises a base configured for engaging with the rear end regulating member, the base comprising a connecting portion connecting with the first and second regulating portions at positions above the sheet stacking portion, and

the first regulating portion, the second regulating portion, and the connecting portion constitutes a regulating surface against which the upstream end of the sheet stacked on the sheet stacking portion abuts.

16. The sheet storage apparatus according to claim 14, wherein the regulating portion comprises a first regulating portion and a second regulating portion arranged at different positions each other in the width direction, and the rear end regulation attachment comprises a connecting portion connecting the first and second regulating portions, and

wherein, in a state where the rear end regulation attachment is attached to the rear end regulation member, the stacking portion is movable upward and downward within a space defined by the first regulating portion, the second regulating portion, and the connecting portion.

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